ON REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

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COUNTRY USSR

REPORT

SUBJECT Technical Specifications of the Soviet AI-20 Turboprop Engine

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SOME TECHNICAL SPECIFICATIONS FOR THE SOVIET AI-20 TURBOPROP ENGINE (FROM A RUSSIAN-LANGUAGE PAMPHLET)

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[Note: x-x-x means word or symbol illegible in document. Underlined word or symbol means guess because of near-illegibility.]

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I. ENGINE BASIC DATA

1.	Designation	AI-20
2.	Type	turboprop
3.	Rotation (of prop and rotor looking from exhaust nozzle)	left
4.	Compressor	
	type	axial
	stages	10
	pressure rise, nominal mode. (H = 8000 at V = 175 m/sec)	
	calculated	8.5
5.	Combustion chamber	annular, ten burners
6.	Turbine	
	type	axial
	stages	3
7.	Exhaust nozzle	
	type	fixed
	exit cross-section, m^2	0.225
8.	Reduction gearing	
	type	planetary
	radio	0.08732
9.	Prop pitch control	
	type	hydraulic
	x-x-x power measured by torque meter hp	NB 46 Rikm (oil pressure in meter cylinders, kg/cm^2)

10.	Rotor rpm idling all operating modes, ground and air	 10,000 ± 200 12300 ± 90
11.	Fuel consumption, idling	380 kg/hr, max
12.	Max Perm. gas temp. at start (fire up)	750°C (recommended use of partial cut fuel to avoid exceeding)
13.	Max perm. measured gas temp after turbine, all modes and altitudes	520°C
14.	Engine permissible continuous operation take-off mode nominal and cruise modes	 15 min (max) unlimited
15.	Transition time from idling to takeoff power, during pick-up	15 sec (max)
16.	Fuel (running and starting)	T-1, GOST 4138-49 Ts-1, GOST 7149-54 T-2, MNPTU 535/55

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17.	Fuel system units	
	a) booster fuel pump	
	designation	707 I
	type	rotary
	trans. ratio	0.1854
	rotation	right
	b) main fuel pump	
	designation	348 I
	type	piston
	trans. ratio	0.3937
	rotation	right
	v) fuel nozzles	
	designation	FR-20
	type	centrifugal 2-duct
	number	10

	takeoff mode fuel pressure before nozzles	74 kg/cm^2 (max)
18.	Oil grade	oil mixture 75% transformer (GOST 98256) 25% MK22 or MS 20 (GOST 101349)
19.	Oil consumption	1.5 kg/hr (max)
20.	Lubrication system	pressure circulation
21.	Oil pumping through engine on nominal mode a) oil entry temp 80°C	135 lit/min (max)
22.	Heat transfer to oil on nominal a) oil entry temp 80°C	850 kcal/min (max)
23.	Oil temp. on sustained modes a) on entry into engine min permissible	40°C
	max permissible, not more than 15 minutes continuous op'n	90°C
	recommended	70-80°C
	b) on exit from engine, max permissible	115°C
24.	Lubrication system units a) main oil pump designation	GMN-20
	type	piston 2-section
	trans ratio	0.4821
	rotation	left
	output (at 12,300 rpm, 70-80°C oil temp	

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1) delivery stage under input pressure 0.6-0.8 kg/cm^2 and back pressure 4 0.5 kg/cm^2 — 240 lit/min (min)

2) scavenging stage under back pressure 2 kg/cm^2 — 275 lit/min (min)

b) aux oil feed pump

designation	MNP-20
type	piston
trans ratio	0.5509
rotation	right
output at 12,300 rpm 0.6-0.8 kg/cm^2 back pressure oil temp 70-80°C	x-x-x

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v) air separator

designation	VO-20
type	centrifugal
trans. ratio	0.5509
rotation	left

g) pump for scavenging oil from oil line of combustion chamber housing

designation	MNO-20
type	piston, 2-section
trans. ratio	0.5509
rotation	left
output at rotor speed 12,300 rpm, 0.5 kg/cm^2 back pressure and oil temp 90-100°C	80 lit/min (min)

d) IKM oil pump (torque meter)

designation	MIKM-20
type	piston
trans. ratio	0.3097
rotation	right
output at 12,300 rpm, 80 kg/cm^2 back pressure	15 lit/min (min)

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ye)	centrifugal vent	
	type	drive
	trans. ratio	0.92
	rotation	right
zh)	oil filters	
	type	gauze strainer
	number	2
25.	Oil pressure, main line	
	all modes on ground	4-4.5 kg/cm^2
	idling	3.0 kg/cm^2 (min)
26.	Control system elements	
a)	auto fuel control unit	
	designation	KTA-5
	type	hydraulic
	trans. ratio	0.4265
	rotation	left
	auto control range	1000-13100 rpm
b)	prop rpm control	
	designation	R-68 I
	type	hydr-centrifugal
	trans. ratio	0.4602
	rotation	left
27.	Propeller	
	designation	AV-68 I
	type	front, four-blade, feathering
	diameter	4.5 m
28.	Auto feathering sensor	
	type	electro-hydr
29.	Starting system elements	
a)	starter-generator	
	designation	STG-12 TM
b)	ignition	
1)	coils	
	designation	KPN-4
	number	2

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2)	plugs	
	designation	SPN-4
	number	4
v)	starting nozzles	
	type	centrifugal
	number	2
	fuel pressure before nozzles	2-3 kg/cm^2
g)	start fuel feed valve	
	type	electromagnetic
d)	starter-generator cut out during starting	
	designation	VE-2S
	type	electrohydraulic
	engine rpm at starter cutoff	4500-6500

30. Anti-icing system elements

a)	icing indicator signal	
	designation	SO-12 AM
	type	pneum-electr
b)	electr control of by pass air for heating compressor guide vanes	
	designation	MP-5

31. Equipment for engine and aircraft operation

a)	starter-generators	
	designation	STG-12 TM
	number	2
	trans. ratio	0.5396
	rotation	left
	permissible drive power	40 hp (max)
	generator mode voltage	30
	current	400 a
	starter mode average current	450 a (max)
	voltage	24/48

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b)	generator	
	designation	SGO-8U
	type	ac
	trans. ratio	0.3305
	rotation	right
	permissible drive power	15 hp (max)
v)	hydraulic pump	
	designation	435 VF
	type	plunger
	trans. ratio	0.1673
	rotation	right
	permissible drive power	15 hp (max)
g)	engine rotor rpm indicator pickup	
	designation	DTE-2
	type	elect
	trans. ratio	0.194
	rotation	right
d)	fuel lever position indicator pickup	
	designation	UPRT-2
	type	electromechanical
ye)	parking brake w/control mechanism	
	control mechanism designation	MZK-2
	brake type	friction-disk
	trans. ratio	0.4602
	rotation	right

[unnumbered page - 11?]

32.	Engine dimensions, mm	
	length	3096 ± 5
	width	842 ± 5
	height	1180 ± 5
33.	Engine dry wt, kg	1075 ± 2%
34.	Guaranteed service life to initial overhaul	200 hrs

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Notes:

I. Air bleed-off behind engine compressor is permitted;

a) routine: - on modes from 0.2 nominal to takeoff inclusive, at all altitudes for pressure boost, ventilation and pressurized cabin heating -- 0.18 kg/sec
in takeoff mode on the ground -- 100 kg/hr

b) extra: - periodically, for deicing other equipment -- 0.12 kg/sec

II. Engine power and economy may not match specifications here with on-board equipment under load and air bleed-off operating.

III. Directions of rotation are in accord with GOST 1630-46.

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The engine automatic system includes positive and automatic feathering of prop blades. Automatic input to the feathering mechanism is controlled by an automatic feathering sensor installed on the forward engine housing and operating off the pressure of the oil in the torque meter. The prop is automatically feathered only on modes greater than 0.9 nominal and only when the prop power in these modes drops to 450-350 hp or torque meter oil pressure drops to $8 \pm \frac{2}{1}$ kg/cm^2.

To prevent prop and rotor windmilling when parked, the engine is equipped with a friction brake for the prop; the prop brake is applied and released by an MZK-2 electrical mechanism.

For suspension on aircraft the engine has four trunnions, two forward ones in the horizontal plane on the housing and two rearward on the butt flange of the compressor and combustion chamber housings set at 7° downward from horizontal. Figure 5 is the engine suspension diagram.

On the forward housing and combustion chamber housing are nipples designed for feeding fire-extinguishing compound "3.5" into the engine oil lines. The nipple on the forward housing feeds compound to the line there and the reduction gearing, and one on the combustion chamber feeds to that oil line.

The nipples have check valves to prevent the oil lines from opening to the outside. These open at 0.5 - 0.2 kg/cm^2 excess pressure of the fire-extinguishing compound.

On the engine are the following units serving for engine operation and providing necessary facilities for the aircraft:

1. Two STG-12 TM starter generators
2. One R-68 I propeller rpm regulator
3. One KTA-5 automatic fuel control unit
4. One high-pressure fuel pump - 348 I unit
5. One booster fuel pump - 707 I unit
6. Ten FR-20 fuel nozzles
7. Two igniters w/centrifugal nozzles and SPN-4 spark plugs
8. Two KPN-4 starting coils
9. One starting fuel electric stop valve
10. One GMN-20 main oil pump
11. One VO-20 centrifugal air separator
12. One MNP-20 auxiliary oil-feed pump
13. One MNO-20 oil pump for scavenging oil from the bearing line in the combustion chamber housing

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14. One oil pump for the MIKM-20 torque meter
15. One centrifugal vent
16. One sensor for automatic prop feathering
17. One SO-12 AM icing signal
18. One VE-2S starter generator hydr. cut-off
19. Engine parking brake with MZK-2 electric mechanism
20. One SGO-8U a-c generator
21. One 435 VF hydraulic pump
22. One DTE-2 engine rpm pickoff

[three unnumbered pages of document containing:]

Figure 4 (Legend)

Longitudinal and Cross-Sectional (along drive center-line) Cutaway of AI-20 Engine Showing Lubrication and Venting Schemes - On two sheets.

1. Fluid feed to centrifugal vent
2. Air lead to exhaust nozzle
3. Oil lead from forward housing to air separator
4. Air and fluid feed to oil reservoir
5. Oil feed from reservoir to auxiliary oil pump
6. Clean oil output from air separator to oil cooler
7. Oil flow from auxiliary oil pump
8. Oil flow from oil cooler
9. Oil feed duct for lubricating reduction gearing parts
10. Oil feed duct for engine parts lubrication and oil supply to equipment units
11. Oil feed from scavenging stage of oil pump for heating ribs of forward housing
12. Oil feed to KTA-5
13. Air bleed-off for labyrinth seal
14. Oil feed to turbine and compressor bearings

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[page 52, including Fig. 26]

At the end of the inner ring there are eleven apertures under the pins 7 which are screwed into the forward housing. These serve to fasten the inner ring and locking tab 4.

The inner ring is fixed by check pin 8, which is pressed into the forward housing.

The locking tab is made of 38 KhA steel, holds the guide vanes and fixes them in a set direction relative to the compressor axis.

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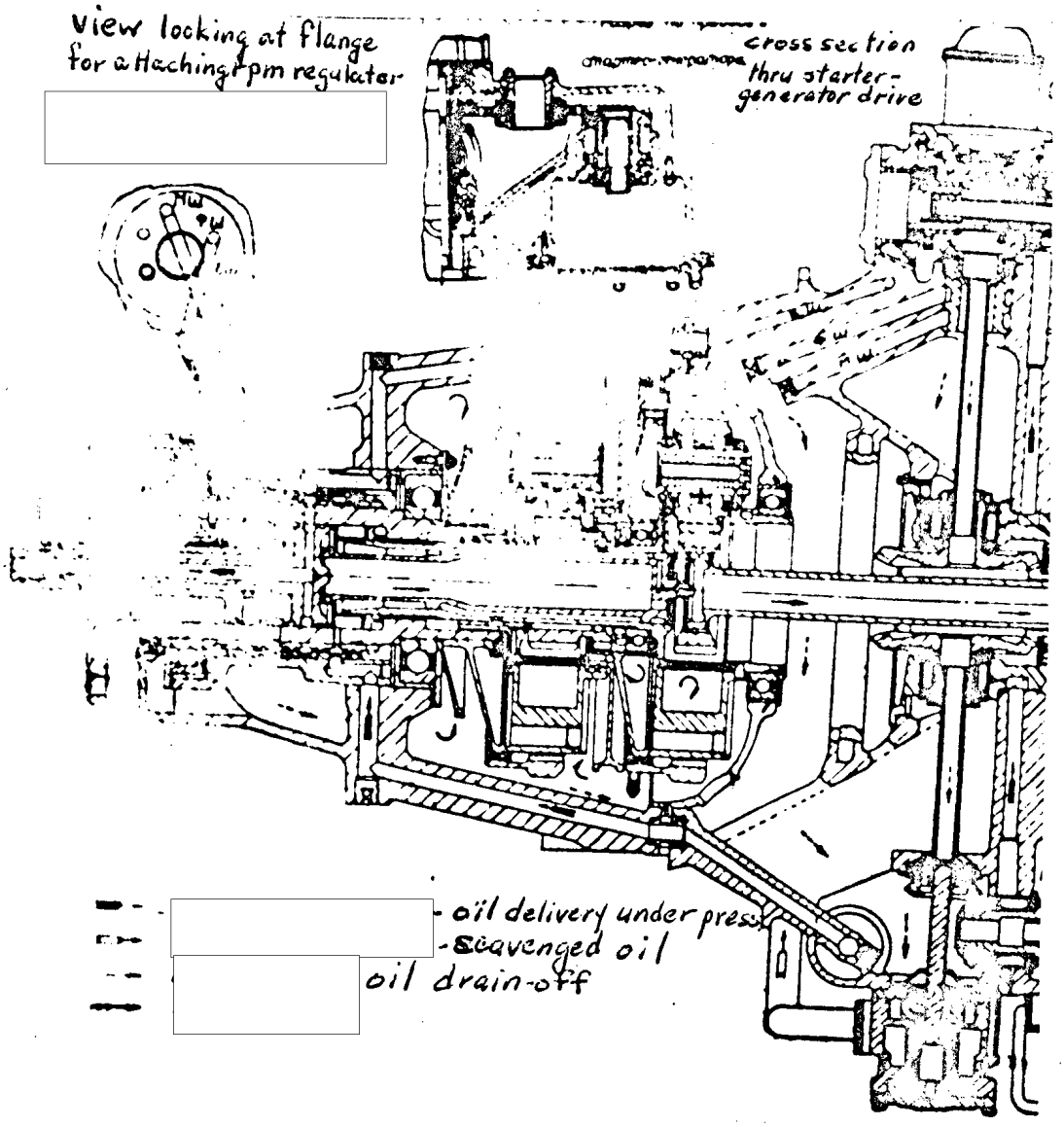

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Fig 4 - a

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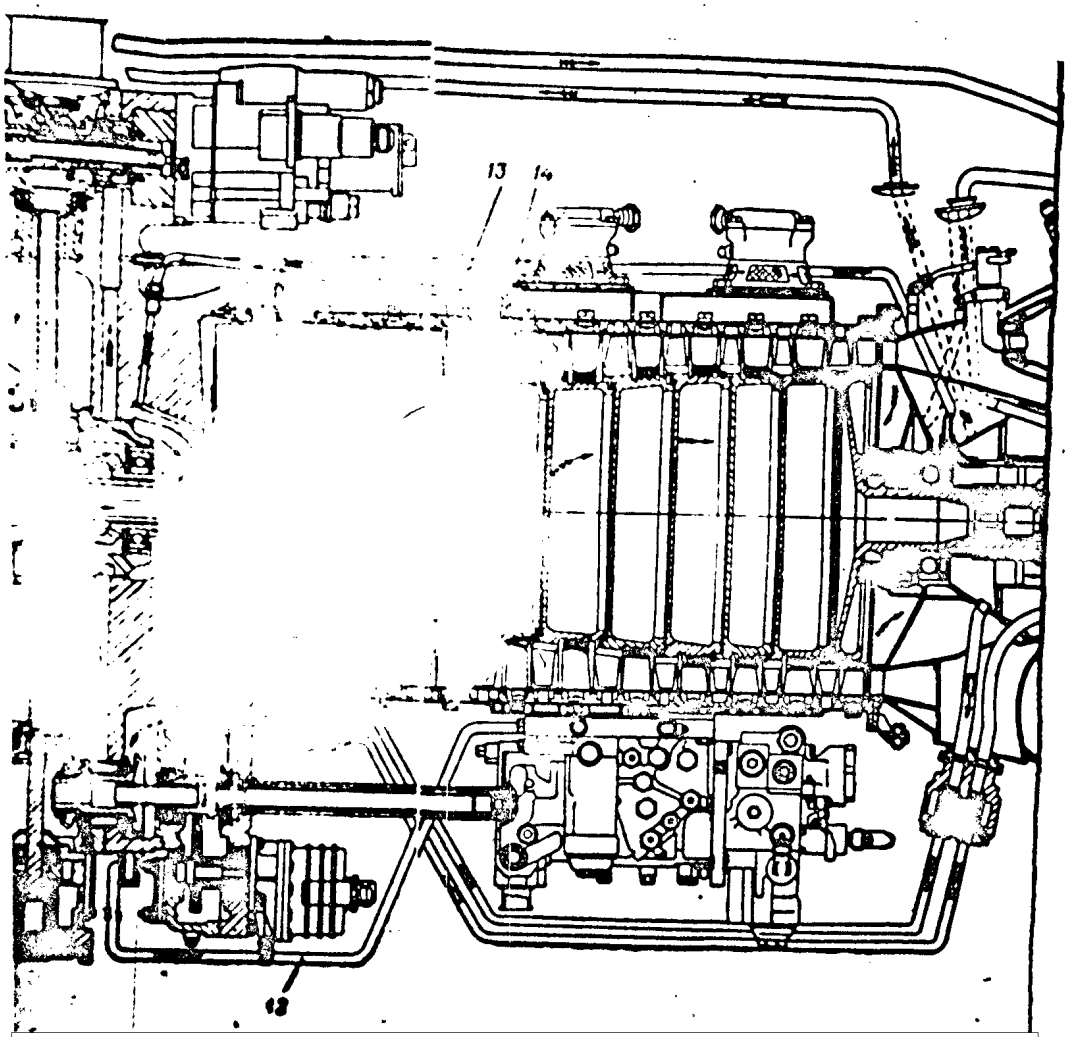

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Fig. 4-b

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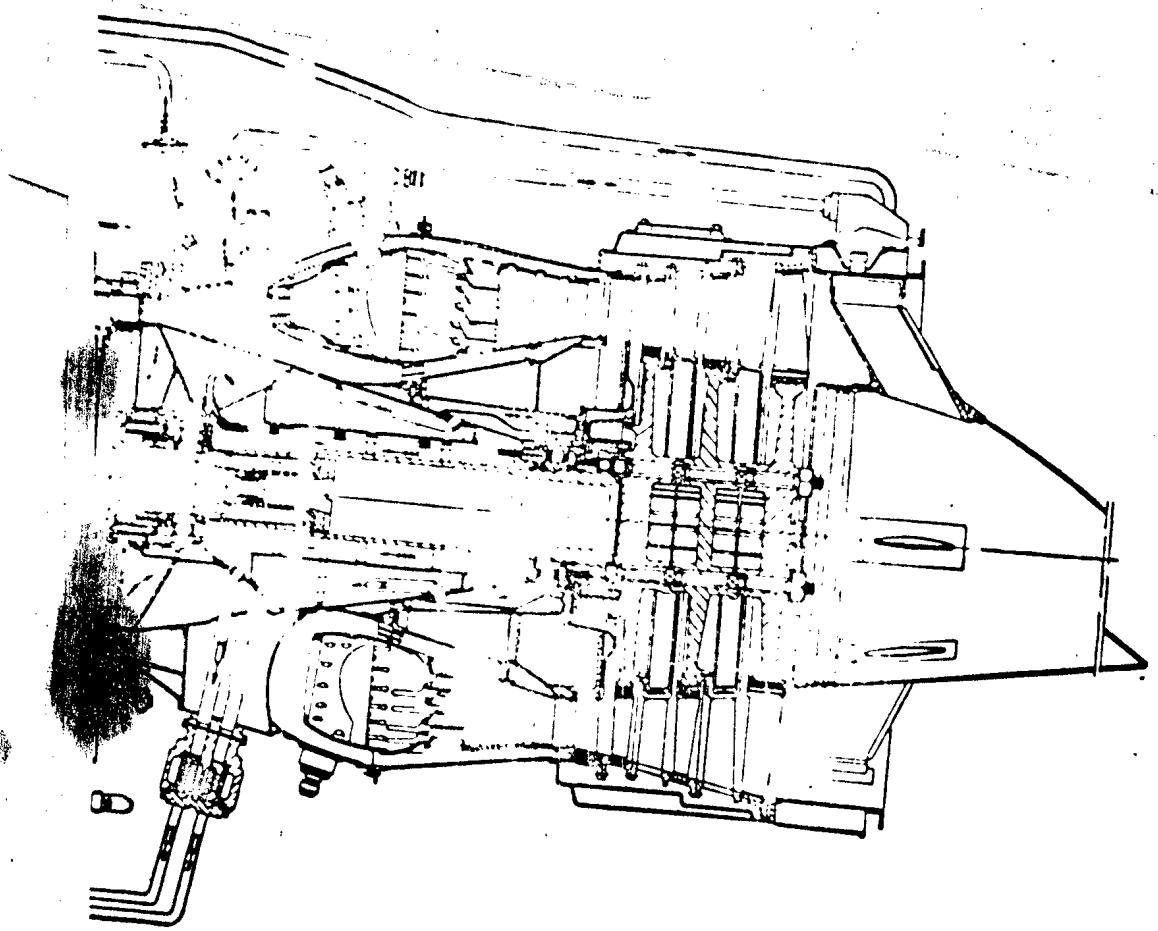

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Fig. 4-c

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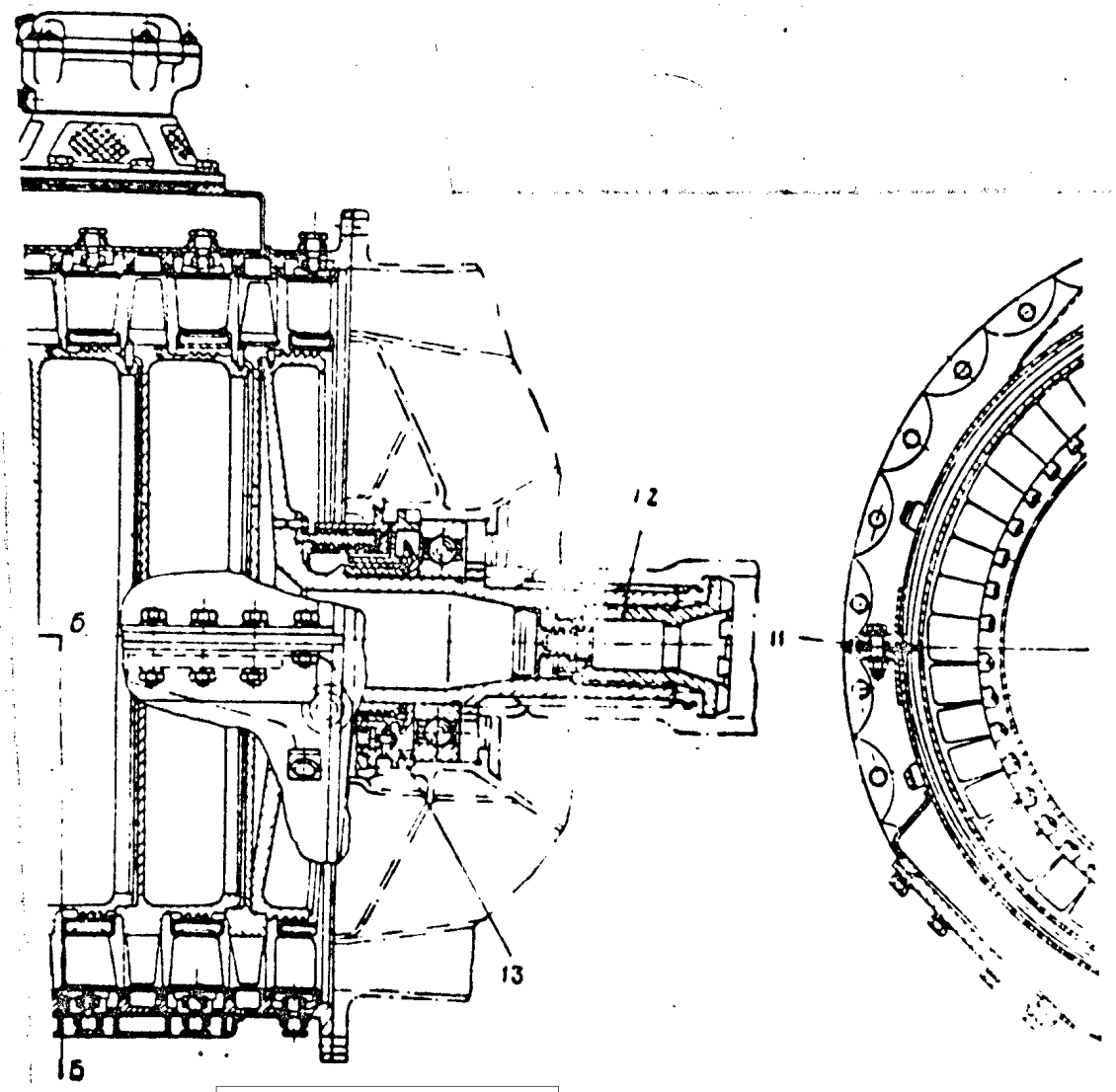

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Fig 16. Compressor

Fig. 18-a

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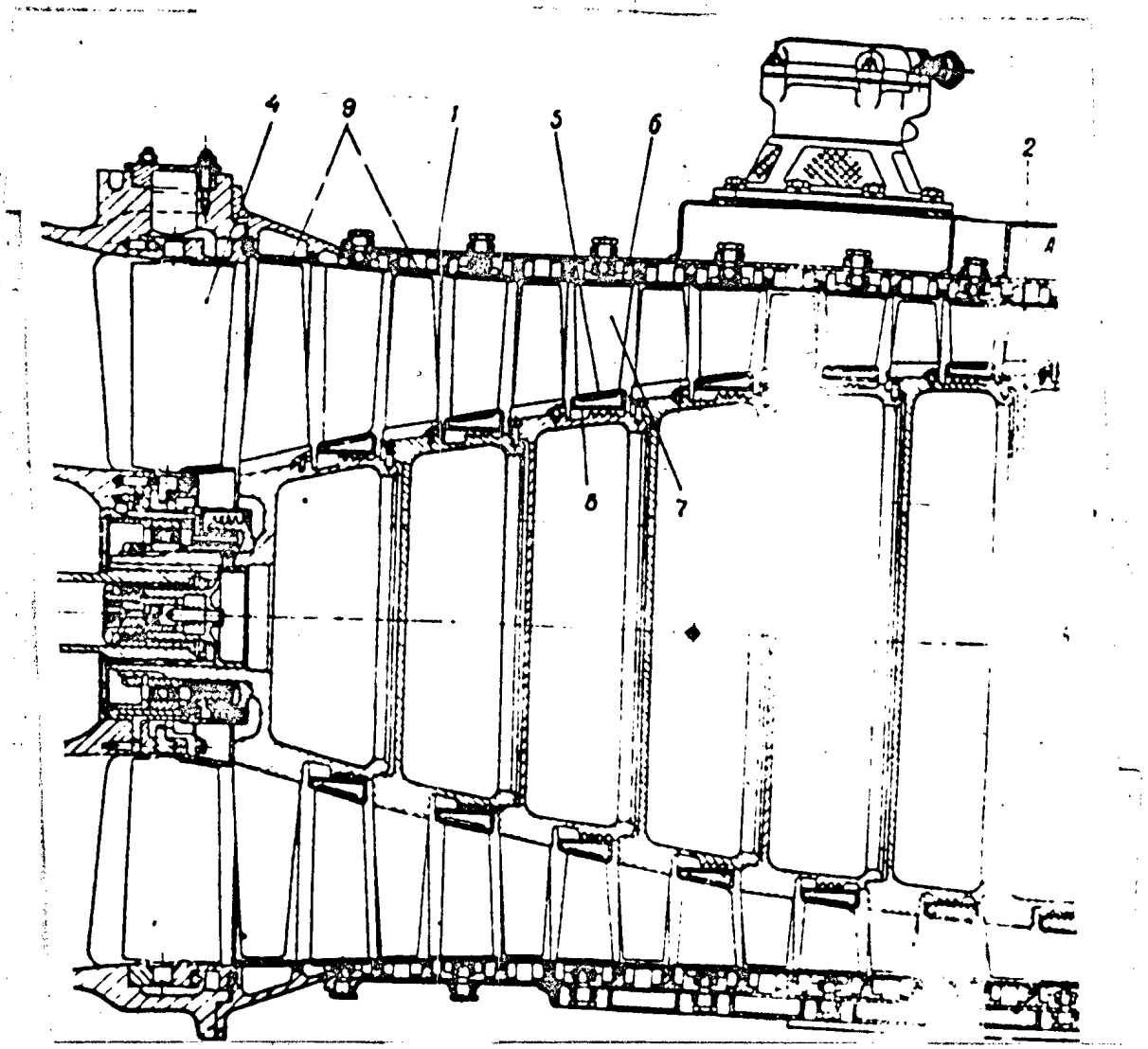

Fig 18 - b

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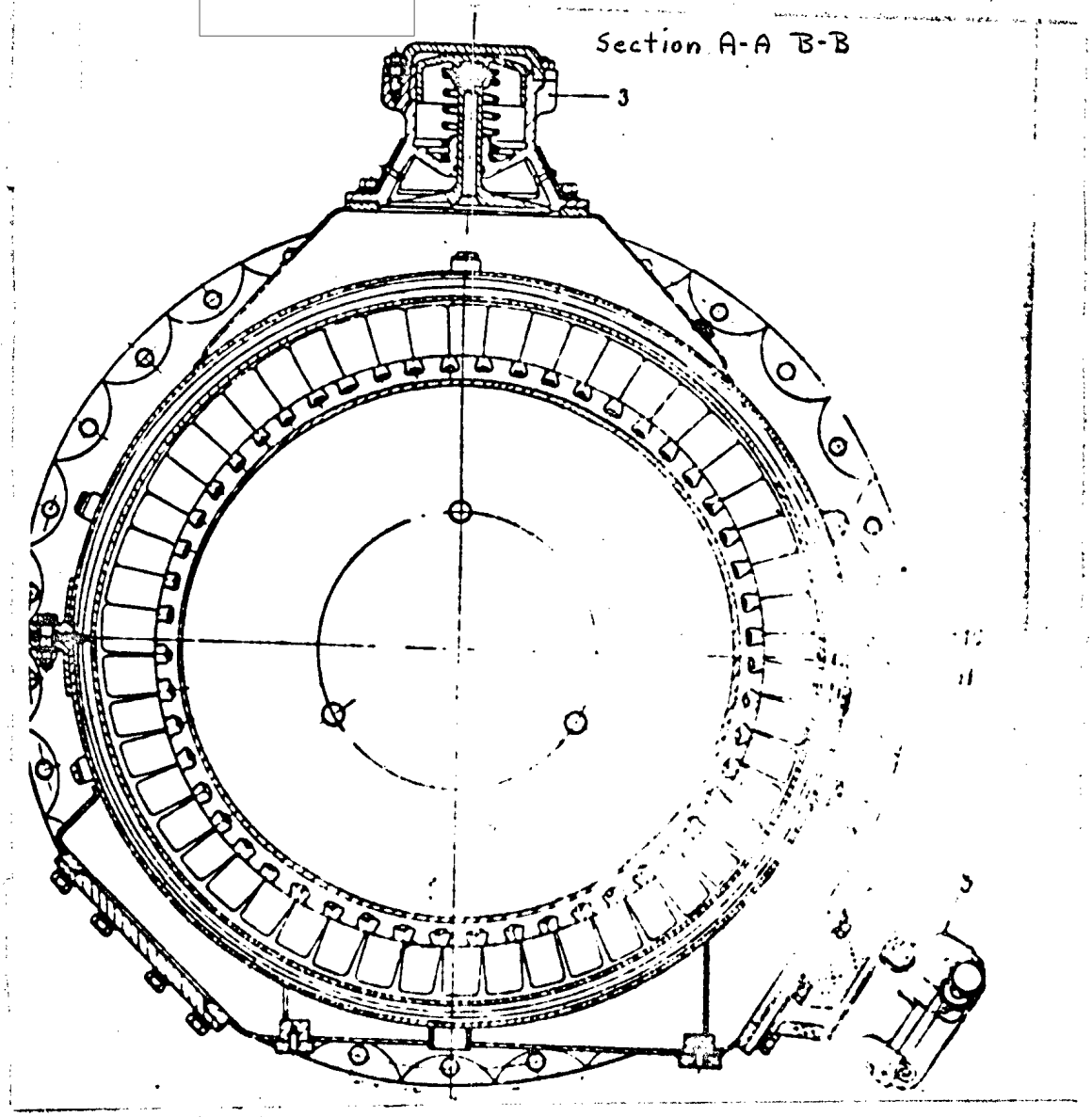

Fig. 18-c

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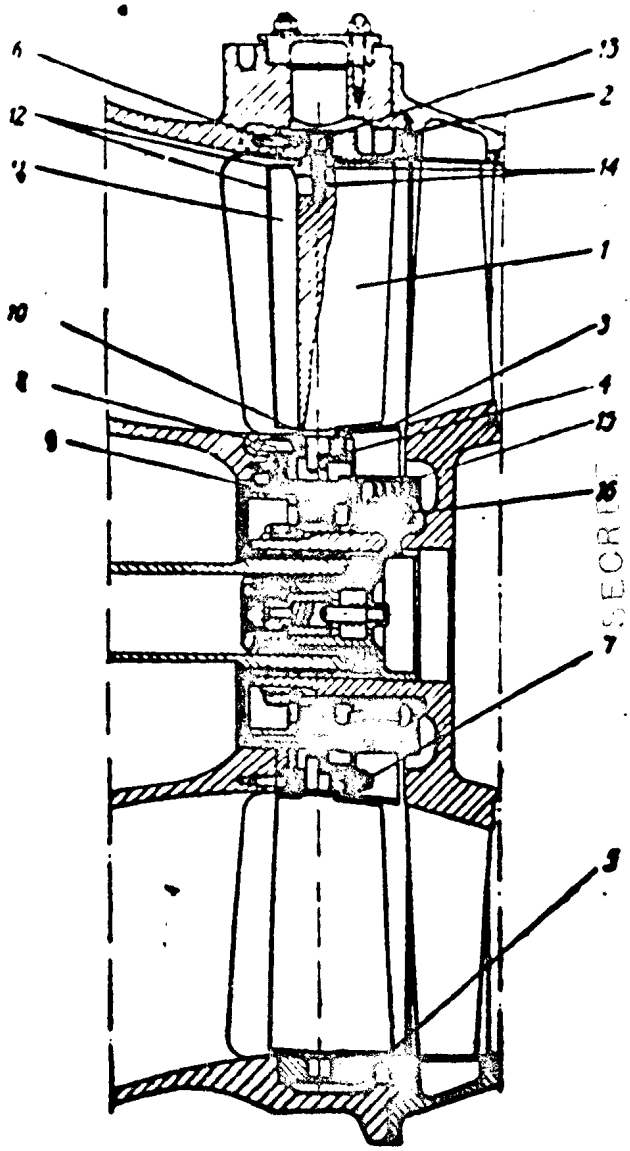

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Fig. 26. Compressor Section Thru Guide Vane Assembly.

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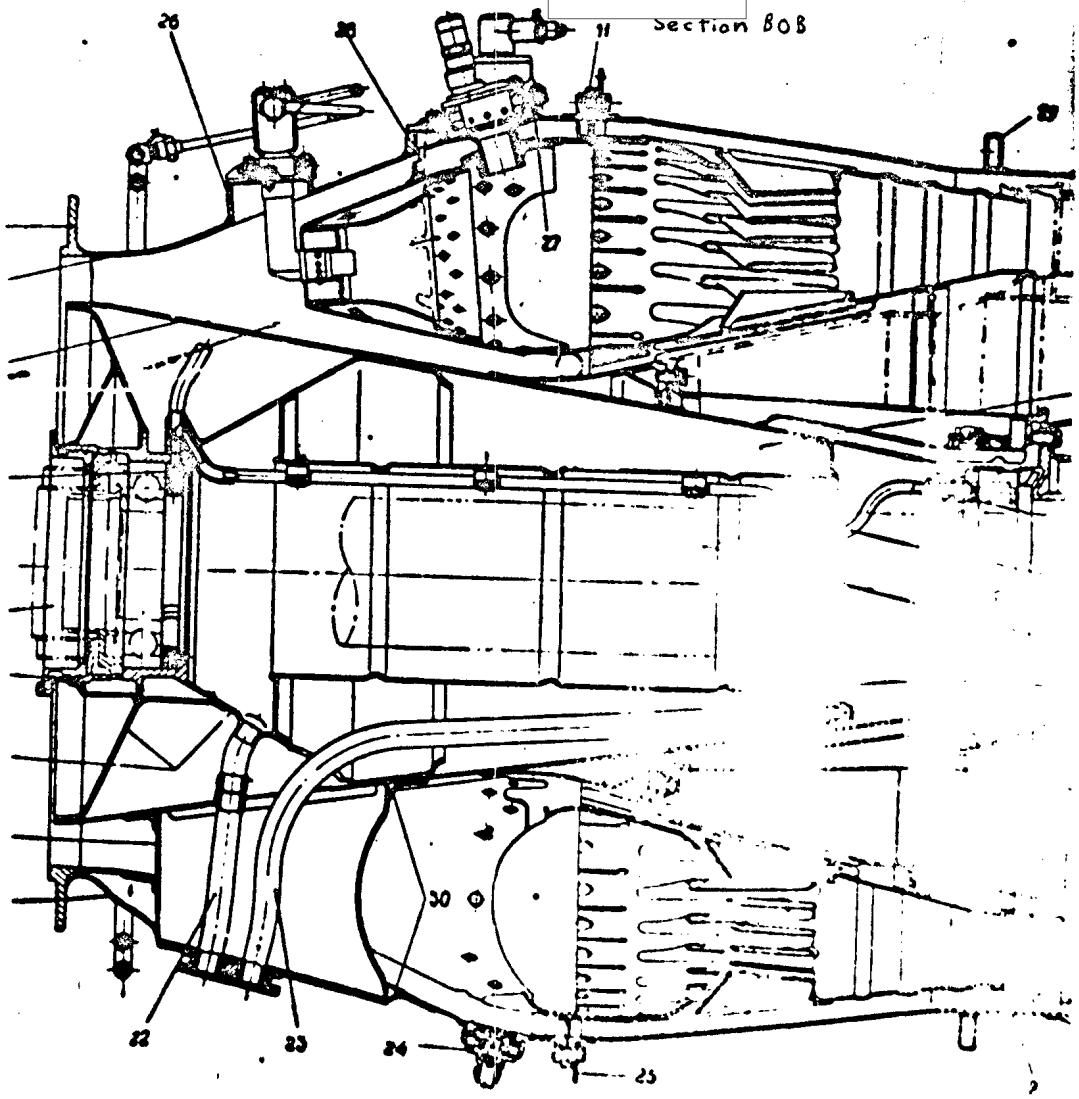

Fig. 27 Combustion Chamber

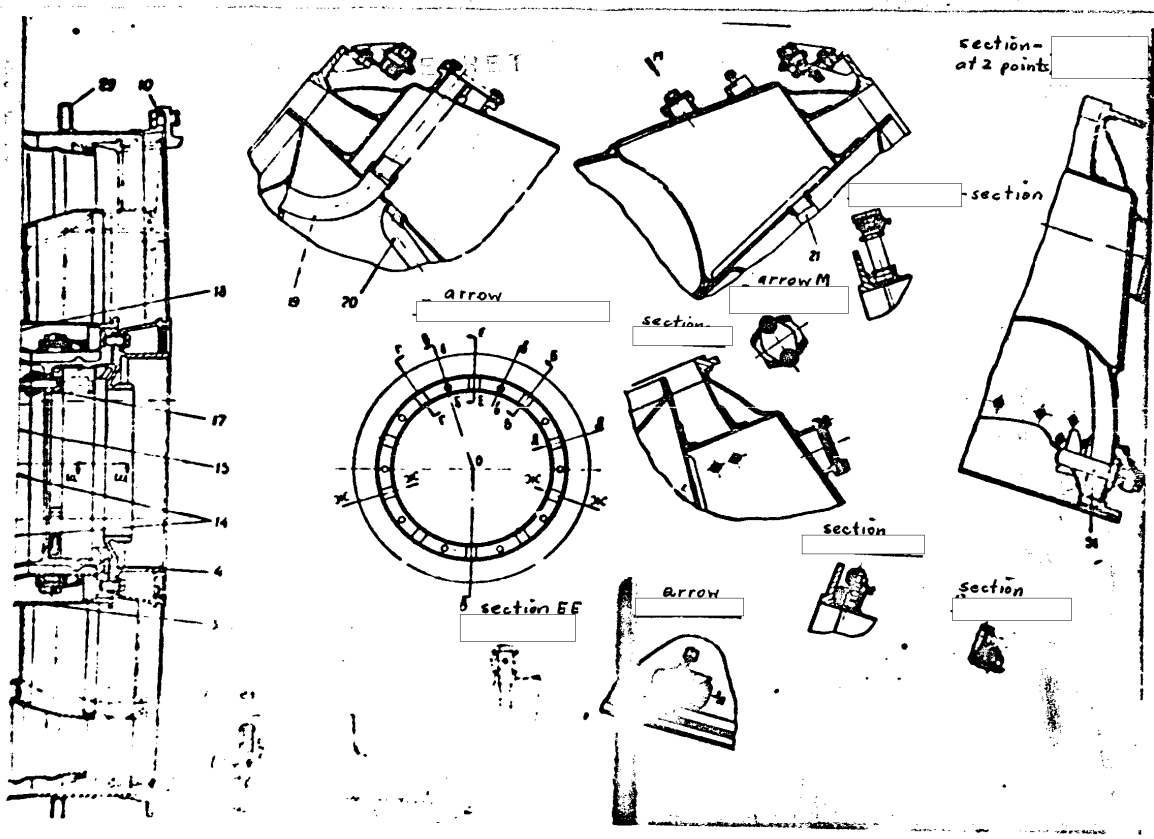

Fig 27. (continued)

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